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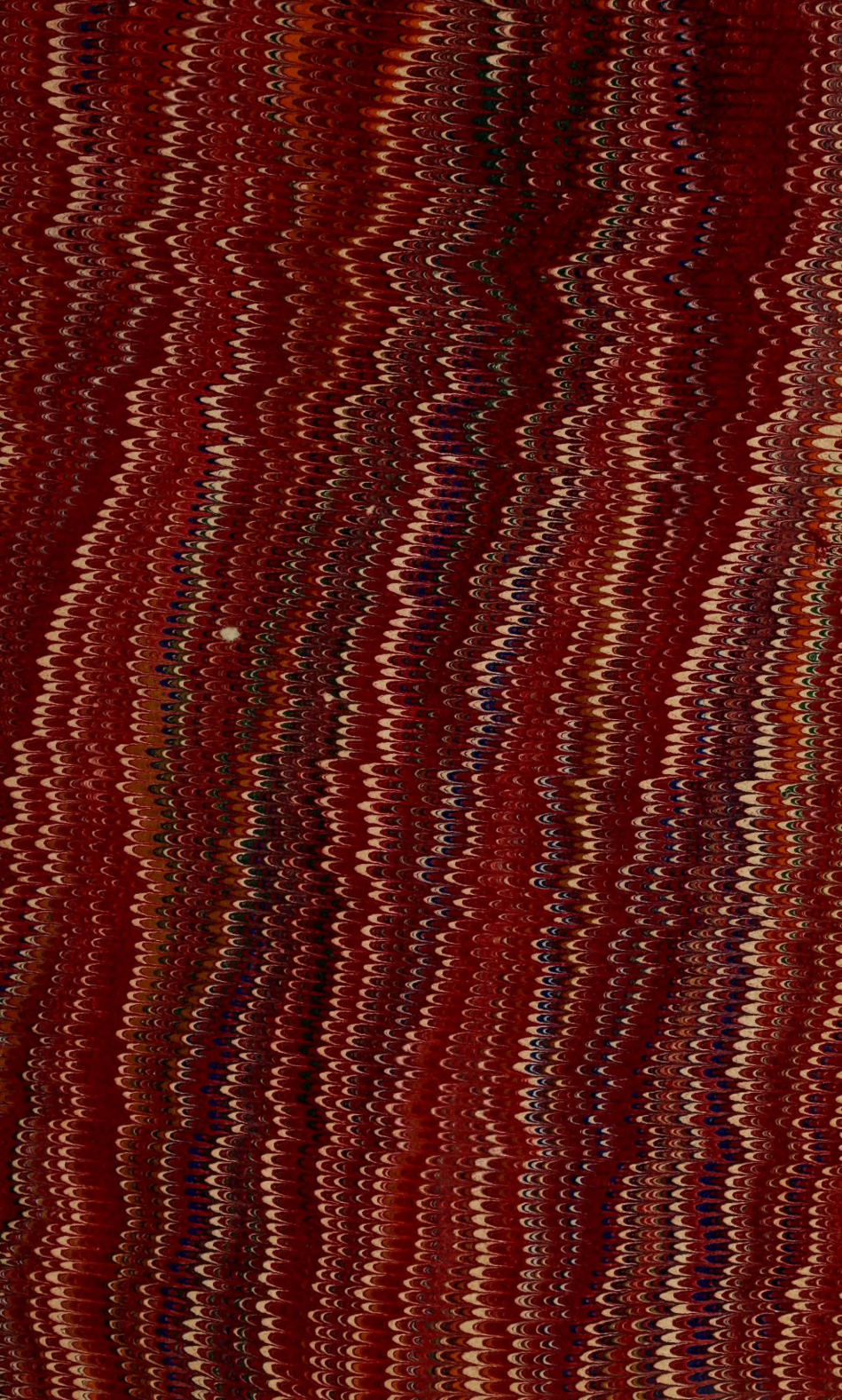
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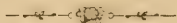






THE GRASS FAMILY.

THE GRASS FAMILY.



AN ADDRESS DELIVERED BEFORE THE AGRICULTURAL SOCIETY
OF CATTARAUGUS COUNTY, AT THEIR ANNUAL FAIR
AT RANDOLPH, N. Y., SEPTEMBER 14, 1877.

BY

PROF. J. T. EDWARDS, D. D.



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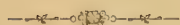
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THE GRASS FAMILY.



MR. PRESIDENT, GENTLEMEN OF THE SOCIETY, LADIES AND GENTLEMEN:

Bountiful crops have again rewarded the labor of the husbandman. We have never had more abundant harvests. In our own immediate vicinity, all these lovely fields and meadows have yielded their richest increase. The fragrant clover, the sweet-scented vernal-grass, the purple-spiked timothy, the rosy-tipped red top, the graceful panicles of oats, the wheat, barley, corn and millet, have clothed the earth with verdure and filled the air with sweetest odors; while, in spite of bugs and grubs, the ground is fairly bursting with goodly tubers, and every hedge and "good-for-nothing place" has blessed the boys and girls with berries by the bushel.

Our orchards are bending with luscious fruit, and our gardens have long paid tribute to the well-spread table. It is delightful to gather here to-day and celebrate these peaceful triumphs of industry; not forgetting Him "whose goodness crowns the circling year."

In beautiful and appropriate words, Whittier has sung of these harvest days. The notes of his lyre are always sweetest when awakened by his sympathy with human trials and successes:

The Persian's flowery gifts, the shrine
Of fruitful Ceres, charm no more;
The woven wreath of oak and pine
Are dust along the Isthmian shore.

But beauty hath its homage still,
And Nature holds us still in debt;
And woman's grace and household skill,
And manhood's toil are honored yet.

O, favors, every year made new!
O, gifts, with rain and sunshine sent!
The bounty overruns our due—
The fullness shames our discontent.

We shut our eyes, the flowers bloom on;
We murmur, but the corn-ears fill;
We choose the shadow, but the sun
That casts it, shines behind us still.

And we, to-day, amidst our flowers
And fruits, have come to own again
The blessings of the summer hours,
The early and the latter rain;

To see our Father's hand once more
Reverse for us the plenteous horn
Of autumn, filled and running o'er
With fruits, and flowers, and golden corn!

Once more the liberal year laughs out
O'er richer stores than gems or gold;
Once more, with harvest song and shout,
Is Nature's bloodless triumph told.

There is a peculiar fitness and value in these September celebrations, now common to the whole country, where the first and most important occupation of man seeks the true and beneficent results of

CO-OPERATIVE EFFORT.

No other assemblies surpass in interest and importance the annual Fairs of our Agricultural Societies. From their rise there dates a new era in human improvement.

One hundred years ago there was not a society of this kind on the continent; now two thousand are enumerated. The Philadelphia "Society for the Improvement of Agriculture" was established in 1784, being the first in this country. South Carolina founded one the same year, and that was next followed, in 1791, by a similar association in New York, which still exists. Statesmanship now deems it wise economy to publish, by State enactment, the proceedings of most of our State societies; and many county and district fairs contribute largely to our stock of useful information, and excite a wholesome rivalry among the farmers of the region in which they are held.

This union of hands and heads has created a complete revolution in the art of farming. From the mental activity thus fostered, have sprung numerous inventions to mitigate the labors of man, and give him more complete dominion over the soil.

In his Political Economy, published about forty years ago, and which is still used in our colleges, Dr. Wayland says; "Agriculture is the only industry which, thus far, has failed to profit to any extent from invention or labor-saving machinery." If the work were revised how would that passage now read? When, for instance, a California farmer tells us that from his own farm forty thousand bushels of grain were harvested, thrashed, cleaned and stored in granaries in thirty-six days, by twenty-two men.

The farmer in this country does not stand alone, but belongs to a co-operative fraternity of more than six millions of men. This comprises about one-half of the persons engaged in all classes of occupations.

In 1870 there were two million six hundred and sixty thousand farms in the United States. It has been well said, that if the labors of the farmer should cease for a single year, the human race would perish, while the hum of all other industries might be hushed, and humanity still survive.

Thus we call the roll of this noble army of toilers, that you may gather courage from your numbers, especially when you remember that there is now, as never before, for the advancement of your profession throughout the land, a grand union of

THOUGHT AND TOIL.

That was a great step forward when men began to *think* of new and better ways, instead of blindly stumbling forward in the old rough ones. Think of our insisting on that long-observed custom, that a man should not hold a plow until he could make one! The farmer has ceased to be a machine; he reads, observes, compares and reasons.

In 1870 there were ninety-three agricultural and horticultural papers and periodicals, with an aggregate annual issue of twenty-one million five hundred thousand copies. In short, the farmer now does what the artist does, "mixes brains" with what he digs. Thought has sifted the soils, introduced the crucible and scales, weighed the elements of earth, air, plant and animal, studied their adaptations, suggested the rotation of crops and the introduction of fertilizers. A hundred years ago, Lord Kames thus describes farming in Scotland. He says: "Our draught horses are miserable creatures, without strength or mettle; our oxen scarcely able to support their weight, and two going in a plow, led on by two horses; the ridges in the fields high and broad, in fact enormous masses of accumulated earth that could not admit of cross plowing or cultivation; shallow plowing universal; ribbing, by which half the land was left untilled, a general

practice over the greater part of Scotland; a continual struggle between corn and weeds for supremacy; the roller almost unknown; no harrowing before sowing, and the seed sown into rough and uneven ground where half of it was buried; no branch of husbandry less understood than manure; potatoes generally planted in lazy beds; swine but little attended to; and very few farms in Scotland proportioned to the skill and ability of the tenant." A sad picture, but often witnessed in those early times, when half the stock would perish in the winter, and the wretched peasantry eked out a miserable existence. But the Scotchmen began to think and study better methods, and mark the results; their rugged soil "buds and blossoms like the rose." The late lamented John Stanton Gould says, that on the beautiful meadows of Edinburg, they have produced in one year, in six consecutive cuttings, twenty tons of excellent hay from a single acre. This would seem to indicate the possibility of

PERENNIAL FERTILITY.

Since Chemistry has ascertained what vegetation demands for its growth, and points out the sources for supply, it only remains for man to furnish himself with these fertilizers, and prolong indefinitely the richness of the soil.

Is it not surprising that more progress has been made in the physiological and chemical knowledge pertaining to this subject, during the last thirty years, than in all time before? Doubtless there is yet great waste. Victor Hugo declared some years ago, that the man who would invent some method of saving the refuse of our cities, which now largely flows into the sea, would be a benefactor of our race. That problem will sometime be solved. In the meantime we have learned this much, that the fertility of land need not be exhausted; for England now supplies a population of twenty millions, from the same soil, that, at the beginning of the century scantily sustained seven millions; and our oldest states are now more productive than they were fifty years ago.

I have alluded to these more general topics by way of showing how vast are the interests committed to the hands of the husbandman, and what benefits arise from an intelligent and studious consideration of the best means for cultivating the soil. The study of agriculture is indeed

THE GREATEST OF THE SCIENCES,

for it includes all the natural sciences and some other branches besides. Prof. Samuel T. Johnson has remarked: "It includes something from nearly every department of human learning. The natural sciences, geology, meteorology, mechanics, physics, chemistry, botany, zoology and physiology are most intimately related to it.

It is not less concerned with social and political economy, than with commerce and law."

Nowhere are the results of scientific study and careful culture more evident and interesting than in the present cultivation of that most important branch of the vegetable kingdom called

THE GRASSES.

We wonder how people lived in the early times when we learn, that, prior to the landing of the Pilgrims, our English ancestors had no potatoes, corn, turnips, squashes, carrots nor cabbages; and are still more surprised to find that, up to that date, there had been no sowing of grass seed, nor artificial propagation of what are termed "forage plants." For ages, on the fertile meadows, nature had been scattering, with prodigal hand, the seeds of the grasses, and the hills and valleys of England were covered with a soft, thick natural verdure. In this country it was different. Our hardy ancestors found no velvety greensward; if they possessed it, it must be through cultivation; hence, grasses were sown in the new world before they were in the old.

King George's soldiers returned, after the close of the Revolution, bearing in their hands the seeds of the timothy, and in their heads the methods of improved grass-culture which they had here observed. It were a question whether this alone has not, in the aggregate, paid England full price for her lost colonies. War is a great disseminator of seeds as well as principles. The defeated crusaders came back from Constantinople bearing with them, from the East, the germs of knowledge and art, which, implanted in Europe, sprang up to adorn it with the products of a higher civilization.

DISTRIBUTION OF THE GRASSES.

I suppose the United States Census Report is not usually regarded as very entertaining literature; but I have been greatly interested in the statements of that seldom-read and much-abused document. Its figures are more eloquent than a poem. No Cattaraugus man can read, without delight, that his own county now produces annually, four million pounds of butter and cheese, and that on her grassy slopes grow two hundred thousand tons of hay. If not literally flowing with milk and honey, there were sold of the former, in 1870, seven million five hundred and fifty-eight thousand nine hundred and seventy-eight gallons, and of the latter eleven thousand six hundred and sixty-eight lbs.

Among the most valuable features of the report is the collection of

CROP MAPS,

which, by a system of shading, show at a glance the relative production of different parts of the country. These maps reveal the sources of our wealth and the adaptation of our soil to a particular crop, as compared with that of other localities. For example; take the yellow map, representing the dairying sections of the United States.

Four shades of color are given, the deepest tint marking those regions where the dairy products are over forty dollars per-capita. You will be interested to know what sections are covered by this golden lustre. They are all in New York, with the exception of a few square miles in California, half a county in Ohio, and the same amount of territory in Vermont: The favored spots in this State are Orange County; a stretch of land through the centre, extending from the junction of the Pennsylvania line with the Susquehanna River, to the Thousand Islands, thence down the St. Lawrence to the Canada line, thence back to the place of starting, embracing half a dozen counties; and lastly, Cattaraugus and Chautauqua counties, comprising in all, perhaps, one-fifth of the State; a pleasant showing, yet how inferior to that in the good time coming, when each acre of the now uncultivated thousands in the valley of the Conewango, shall yield, as I have no doubt it will, five tons of waving timothy and cock's-foot, presenting a picture more beautiful than the Northampton meadows or the green fields of the Mohawk. Passing the tobacco map, which, I am happy to say, shows this corner of the State in virgin white, we next glance at the

HAY MAP.

This appears in five shades of crimson, spread upon the white page. The deepest color is scarce again. There is a little of it in Maine, one small spot in Vermont, three or four counties in the centre of New York, the whole of Cattaraugus county, and about one-third of Alleghany, Erie and Chautauqua counties; then no more until we reach the magnificent grass-lands of Minnesota, Iowa, Nebraska and Kansas, although it is by no means continuous there.

THE CORN CROP MAP

does not give New York an acre, even in the faintest shade; and yet corn, a true grass, as we shall see hereafter, grows well here, often yielding fifty or sixty bushels to the acre.

THE WHEAT CROP MAP

leaves this corner of the State in pure white; a little strip in the valley of the Genesee rises to the dignity of second grade, but there are two grades above it, the highest being found in California alone.

A careful examination of these four members of the great family named, reveals the fact that the Mississippi Valley, with its mighty tributaries, is destined to yield the corn and wheat for this, and perhaps other lands, when a teeming population of many millions shall throng these shores, as did once the mighty multitudes along the Nile, the Tigris and the Euphrates. Population has ever sought fertility of soil, and there is a very close relation between the crop returns and the census of population. It has been recently shown that there is also a close connection between crops and crime.

We learn from these maps that we, in this section, are not to depend upon corn and wheat, but upon those humbler, but not less useful members of this family, commonly called the forage plants. These constitute the bountiful source of our prosperity, of well-filled barns and overflowing milk pails; not "the green herb for the use of man," but the grass grown for cattle.

As there is frequent occasion to mention the term family, it becomes necessary to inquire what, in a botanical sense, is

A FAMILY.

It is not what is understood when we speak of families among men, for then we refer to the group of persons living in the same domestic circle, or possibly a collection of individuals closely connected by the ties of blood. The term family is the name for a very wide class of plants, which embraces many genera, and each of these in turn, many species. What, then, is a species? A species is a collection of individuals which have a common parentage, and also possess certain essential characteristics in common.

We do not propose to enter into a learned discussion in regard to the origin of species, but so far as we *know*, one species does not become another: Important changes may take place, thus forming strongly marked groups, and these we call varieties. Thus we obtain varieties of the species horse, or varieties of apples and potatoes. One man raised 6,000 varieties of potatoes. Individuals with a common parentage, then, form a species; of these thousands of species some look alike, have similar habits, and other points of resemblance; those having these correspondences form a genera;—again of these thousands of plant genera, you may find some which have features alike as to flower, fruit and mode of growth. These are grouped into a large class called a family. Individuals form species, species form genera, genera form families. This is equally true of both sub-kingdoms of the organized world. Perhaps it can be most readily seen among animals. For example: there is the cat family, embracing the lion, tiger, leopard, panther, wild-cat, and some others. Place them together, and no one will fail to see that they resemble each other. The dog family, including the hyena, jackal, fox, wolf and dog, have so striking a resemblance to each other that many have supposed that they are of common parentage, which is not the fact. But while different species may produce monstrosities, monstrosities do not perpetuate themselves.

We shall now see what is meant by the

GRASS FAMILY.

This is a great collection of plants called the Gramineae, which, according to Wood, includes 300 genera, and 3,800 species, or about one-sixth of all the plants in the world. What then is a grass? It is a plant with a hollow stem, having joints that make a horizontal par-

tition across the stem, with leaves which form an open sheath part way up the stem, terminating usually in a slender blade, and generally, at the point of junction of the blade and sheath, has a small appendage called a ligule.

The grass is further distinguished by its growth, flower and fruit. The stem or culm terminates in a flower-stalk, which is usually a spike, racine or panicle, terms which a little investigation will make clear. The flowers are very small, and you will look in vain for the showy petals and sepals which adorn our roses, pinks and lilies; in place of these, enclosing the essential organs, the stamens and pistils, there are scaly leaves called palea and glumes, other names for what the miller calls chaff. The seed-vessel is simple, with one ascending ovule or seed, which divides into two styles, and these terminate in two feathery stigmas. When the ovule ripens it forms a grain called caryopsis. The leaves have veins running lengthwise, and grow on opposite sides of the stem, one above another.

The grasses are often confounded with the sedges, a numerous family, embracing 2,000 species, but the latter have a solid stem and closed sheath. The clovers do not belong to this family, but are often called the "artificial grasses." They have, however, a different leaf, flower and fruit.

It is a singular testimony to the value of the grasses, that there is but one species in all this vast collection that possesses poisonous properties, and that is the bearded darnel (*Solium temulentum*), a rare plant, sometimes found in grain fields.

This noble family stands as the connecting link between the mineral and animal world, transforming, with unerring skill, the in-nutritious elements of the former, into food for the latter.

"All flesh is grass," says the inspired penman; and "all flesh is grass," repeats the man of science.

The poison ivy, the sumac, the nightshade, the laurel, and hundreds of other plants, may distil from the same soil their noxious juices, but this faithful ally of the human family, with unvarying certainty, stores up its nourishment for man and beast. It has a marvelous power of adaptation to different situations and climates. Some of its representatives, found on the coast of Greenland, are scarcely longer than the hairs upon a squirrel's back, while in the tropics others rise to the height of lofty trees. I have, myself, seen corn grow fifteen feet in height. So that Dean Swift, in his masterly satire, was not so far from the truth, when, speaking of the land of giants, he said: "That which surprised me most was the height of the grass, which, in those grounds, was about twenty feet."

An American poet has written a graceful lyric, in the refrain of which he makes the grasses say: "I come creeping, creeping everywhere;" and surely there is scarcely a spot where they are not found. Dr. Kane, in his Arctic travels, gathered their stunted stems, and,

alas! mourned their loss when the rats broke into his collection and ate them; but he consoled himself with the reflection—a comforting one, for the crew had the scurvy—that they might catch the rats the fatter for the meal.

They carpet the meadows, climb the hillsides, fringe the brooks, and even in the deep, shady nooks, lift toward the giant trees their slender, graceful heads. The snows of the mountains have hardly melted before the valleys smile with their verdure, and the rugged rocks are robbed of their harshness by the twining grasses in their clefts. Even the shifting sands of the ocean beach are held in place by their long and fibrous root-stalks. Nature has provided that their seeds should be almost indestructible. They have lain in the ground for hundreds of years, and under favorable circumstances have germinated; they have been found in the ancient tombs of Egyptian kings, and with sunlight and moisture have sprung again to life. This characteristic renders them invaluable to man, as they may be stored for a great length of time in granaries.

Thousands of the Gramineae are comparatively unknown, and a select few only can be here considered. These are the more aristocratic members of the family, although some of them are of humble origin. Dr. Holmes has remarked, that it is not wise for us to be too particular in looking up our genealogical line, for we may find it waxed at the other end, or terminating in a slip-noose. But if any of these noble scions of the grass family are reproached with their lowly pedigree, I can imagine them replying, in the language of Cicero, to a young sprig of the Roman nobility, who reproached him with his humble birth: "The difference between you and me, is this: the greatness of your family ends with you; the greatness of mine begins with me!"

We propose to speak briefly of about a score of species. If any are disposed to pursue this interesting study still further, they will find rich material in the exhaustless treasures of Prof. Gray's botany, and in the admirable treatises on Grasses by Flint and others. In 1869, John Stanton Gould wrote a very learned lecture on this subject, which was printed in the Agricultural Report of the State Society of that year; and I have been shown, by the accomplished Secretary, Mr. Harrison, a work in manuscript upon the artificial grasses, by the same author. Both these treatises would be a perfect treasure to the farmer, if published for general distribution. Agriculturalists long felt a contempt for the theorizings of book-farming. One of these theorizers has been thus sarcastically described as "spending eight years upon a project for extracting sunbeams out of cucumbers, which were to be put into vials, hermetically sealed, and let out to warm the air in raw, inclement weather." After all, the dreamer was not so far out of the way, for what are cucumbers but condensed sunshine?

We have learned to respect these investigators, and that a spirit of observation and research is a fruitful source of agricultural progress. There is a saying which has been so often misquoted, that I venture to give it literally. It occurs in Gulliver's Travels. The King of Brobdingnag says: "Whoever could make two ears of corn or two blades of grass grow upon a spot of ground where only one grew before, would deserve better of mankind, and do more essential service to his country, than the whole race of politicians put together." A computation has been made of the financial results of making the two blades of grass grow where there was but one. As the annual hay crop of this country is estimated to be worth \$400,000,000, the increase to our revenues thereby would be, in three years, over a thousand million dollars; and there are those who claim that it is possible, in a short time, to accomplish this work. If this be so, surely a careful and scientific study of the grasses promises the richest results.

HERD'S GRASS, TIMOTHY, CATS-TAIL GRASS.

(*Phleum pratense*.)

The last of these names was given to this grass on account of the supposed resemblance to the caudal appendage of the cat. The first was derived from the name of a man, who found it growing in Piscataqua, N. H., in the early part of the last century, and began to cultivate it. Afterwards it received the name of Timothy, from Timothy Hanson, who cultivated it extensively in North Carolina, and recommended it to the people of Great Britain. Some authors state that it was introduced into England, from Virginia, by Peter Wynche, in 1761. It is generally regarded as the most valuable of our grasses raised for hay, and is used extensively in Britain, Lapland, Sweden, Norway, the United States and Canada. According to chemical analysis, it is the most nutritious of our grasses if cut at the right time, and commands the highest price in market. The proper time for cutting has long been a question of discussion, but our best authorities now agree that it is when it is about half blown. If the stalk is examined at this time, a yellow spot will be found above the first joint. At this stage, the nourishing matter is in the leaves and stem, but should it be permitted to go beyond this, much of it will pass to the seeds, and when dead ripe most of the seeds will fall in handling the hay, and there will thus be left for the cattle nothing but the dry and tasteless stalks. Any farmer, with the slightest observation, must have noted the difference in the appearance of his cattle when wintered upon the one kind or the other. There is a very important reason why it should not be cut *before* this period. Nature has a wonderful way of storing up nourishment in the seed or root of the old plant for the use of the new. This is seen in many of the bulbs and seeds used by man for food. The same arrangement is found in timothy. About the time of flowering, a bulb is formed,

just beneath the ground, (though one kind of timothy has fibrous roots), and in it is packed away, through the elaboration of the leaves and stem, a large amount of nutriment upon which, when the grass sprouts again, it feeds. Again, it has been found essential not to cut below the lowest joint. There is reason to believe that most of our mowing machines are set too low. Timothy is not a good grass for pasture, for reasons that have been intimated. The rowen grows slowly, and when horses and sheep feed upon the pasture, being very fond of the bulbs, they nip them or pull them up, and thus "kill the hen that lays the golden egg." The greatest yield of timothy upon a single acre in this country was six tons. The tallest stalk was raised by Charles Collins, Montgomery, Pa., and measured seven feet and eight inches. The longest spike on record was eleven inches. The average crop, throughout the United States, is one and one-quarter tons to the acre. When in full bloom, its purple blossoms trembling at the zephyr's touch, and the tall stem swayed by each passing breeze, it presents a very beautiful appearance.

MEADOW FOX-TAIL.

(*Alopecurus Pratensis.*)

This is a grass which closely resembles timothy, and is often mistaken for it. It is not abundant here, but may be occasionally found. This plant flowers the first of June, and may be known on this account. It can be further distinguished from the fact that the head of timothy is longer, and is rough to the touch, while this is smooth. This is one of the earliest and best pasture grasses known. Cattle are extremely fond of it, and it bears cropping admirably; but if cut for hay the loss from drying is very great. It is the principal grass in most of the rich natural pastures of Great Britain.

Mr. Way, who made a careful chemical analysis of many grasses, shows that on account of the loss in curing, when this is worth four dollars and fourteen cents per ton, timothy would be worth ten dollars. Yet all agree that as a pasture grass it has no superior. It is early, sweet, and renews itself very rapidly.

There is another Fox-tail, sometimes called Bottle-grass and Corn-grass, of quite a different character. It is found in corn fields, barn yards and potato patches, and is usually voted a nuisance, although, if we should ask the birds, they might give a very different verdict, as they seem fond of the numerous seeds which crown its summit.

RED-TOP, FINE-TOP, BURDIN'S GRASS, (Herd's Grass in Pennsylvania and the South,) RHODE ISLAND, BENT.

(*Agrostis Vulgaris.*)

This must have been common among the Greeks, for the name *Agrostis* signifies field. If you should go to a dealer and inquire for either of the above named grasses, he would probably tell you that

he kept them all. But he would furnish their seed from the same barrel; they are really one. It is a grass that exhibits itself under quite different aspects in varying situations. Sometimes the panicles are very slight and graceful, at others, strong and tall, but almost always distinguishable, from the brownish red of its blossoms. It is a good pasture grass, though the cattle give it a second or third place in their choice.

ORCHARD GRASS, ROUGH COCK'S-FOOT.

(*Dactylis Glomerata.*)

I have been greatly interested in studying this grass, and I am satisfied that it could be more extensively sown in this region, with great advantage. It grows luxuriantly, and matures by the middle of June. Its aftermath develops so rapidly, that in many cases it would be easy to secure a large second crop. No grass suffers less from cropping, or grows more rapidly afterwards. One farmer says if his cattle went to bed without supper, they could have a good bite for breakfast. Some time ago, a collection of grasses was presented to a jury of cows, and they expressed a decided preference for orchard grass. The roots are fibrous, and consequently not easily injured. As it ripens about the same time as clover, if sown together, they could both be cut at the most appropriate season, which cannot be the case when clover and timothy are sown, for they ripen at different times. I saw a piece this summer, sown on a lawn. A worse mistake could hardly have been made, for its mode of growth unfits it for that purpose; but it gave a most magnificent yield of three tons to the acre. I am satisfied that the farmers of Cattaraugus County should give this grass a trial, especially where they are sowing for permanent pasture.

JUNE GRASS, KENTUCKY BLUE GRASS.

(*Poa Pratensis.*)

This plant, which is very common in our own fields, forms the prevailing forage of Kentucky. It may be known from its early blossoming, and from a woolly web at the base of its flowers. The famous pastures of Kentucky will fatten cattle faster than any other in the world. "Where do you get your best cattle?" said I to an extensive dealer in New York. "The corn-fed cattle of Illinois," he replied, "are best. Kentucky cattle rank second. Texas cattle are the poorest meat of all."

Blue grass gives the green tinge to the mountains of Vermont, which may appear a little paradoxical. Though blossoming so early, it sends out a luxuriant growth of radical or root leaves, which make capital after-feed, often remaining green all winter. In Kentucky, the horses and sheep paw the snow away and eat it. It seems to bear extreme cold better than any grass known. It is often found three thousand feet above the level of the sea.

It seems to be fitted for a pioneer, and it is said that having once fastened itself upon the prairies of the west, it will sometimes displace all other grasses. Graceful and fairy-like in its movements, and associated with our remembrances of the first sweet green of Spring, we look upon it as an old friend, and herald its coming with gladness.

SWEET-SCENTED VERNAL-GRASS.

(*Anthoxanthum Odoratum.*)

Englishmen often speak of the fact that their hay is sweeter than ours; if so, it is largely due to the presence of this grass, as it is found abundantly in old meadows.

There are not many of the grasses which emit agreeable odors, but this is perhaps most marked of all. Shakespeare makes Richard the Third exclaim, as he cools his fevered brow by walking in the fields on the night preceding the battle which cost him a crown:—"How sweet the fragrance of the new-mown hay." From its flowers there protrude little sharp appendages called awns, which are strangely sensitive to the changes of the atmosphere. They are pretty good hydrometers on a small scale. If placed on the table they will contract and expand in a very peculiar manner, as if they were living beings and in a nervous state of health. The awns of wild oats have the same peculiarity. This grass is not very valuable, but those who find poetry in the hay field, and enjoy the sweet scent of the well-filled mow, will be loth to part with it.

ANNUAL SPEAR GRASS.

(*Poa Annuæ.*)

Mr. Flint thinks this is the most common of all our grasses. It looks very much like June Grass, but may be distinguished from it by not having the fuzz below its flowers, and by having sword-shaped leaves, crumpled at the ends. It flowers throughout the summer.

I have now mentioned seven of our most common and valuable grasses. They probably comprise nine-tenths of all the growth of our meadows and pastures. A few others are particularly interesting for their peculiarities of structure, or the curious purposes which they serve.

BLACK GRASS.

(*Juncus Bulbosus.*)

Along our Atlantic sea-board it is exceedingly difficult to raise good grass for cattle. The meadow lands are low and salt, being often covered by the waters of the bays, and on them are found sedges in abundance. Salt hay, so called, is also found there in great quantities, but these are not very nutritious; still they are cut in vast quantities, and sometimes shipped to the city markets. I have often seen men loading scows with this hay, putting on board, perhaps, ten or twenty tons, then sailing away thirty or forty miles distant,

the whole looking like a huge hay stack with white wings. There is one important exception to the inferiority of these sea-shore grasses, and that is the black grass. Just along the line where the salt meadows and the uplands meet, it grows from ten to twenty inches high, crowned at the top with a bunch of heavy and nutritious seeds. When combined with the goose-grass, (so called because the Canada goose likes to feed upon it), if well cured, it makes a hay equal to timothy.

BEACH GRASS, MAT GRASS.

(*Calamagrostis Arenaria.*)

This has been called the most advanced sentinel of the vegetable kingdom. It is found on the sandy coasts which form the barriers of the sea. Many a time, when a boy, going to bathe in the surf, I have pricked my feet with its thorny chaff, and wondered what that grass was made for, little dreaming then, that this despised and ugly-looking member of the vegetable world often accomplishes tasks which defy the skill and appliances of the best engineers. It has been found to be one of the surest protections for our sandy coasts. The harbor of Provincetown, on Cape Cod, one of the best in the world, owes its preservation to it. In England there exists to this day a statute against pulling it up or destroying it. Along the sea-board the winds sometimes blow with such force that they would sweep away the light, sandy soil, and often fill the bays and inlets if there were not this protection. I have seen windows in the houses on the beach, having the exact appearance of ground glass, made so by the sand that had been blown upon them. Beach grass comes to the rescue. It grows with long, reclining subterranean stems, sometimes forty feet in length, from which the blades shoot up, making a net-work over and through the sand. If the sand is blown upon it and the grass is buried, it continues to thrive, and, indeed, seems to be improved by this hard usage.

COMMON CRAB-GRASS, FINGER GRASS.

(*Panicum Sanguinale.*)

Before passing to that branch of the grass family which furnishes food to the human race, we pay a passing tribute to a representative of that despised tribe of the gramineae called weeds. A weed has been defined as "a plant, growing where it is not wanted." This one said to get its name, *Sanguinale*, bloody, from the practice of boys in Germany pricking each others' noses with its sharp spikes until they bleed. Some of us remember how industriously we have labored to eradicate it, and were surprised to find, if it had rained shortly after, that we had planted a score of weeds where there was but one before. However, it has its merits, for its five-fingered inflorescence gives it a curious appearance, and its seeds are greatly relished by the birds. Perhaps this feeding of birds is not regarded as an essential

part of farming; but a greater heresy than that has never cursed the profession. If you would preserve your grasses from the bugs, worms, caterpillars and grasshoppers, welcome the birds to your homes. Plant trees for them, build boxes for their nests, and don't begrudge them a few berries and cherries.

RICE.

(*Oryza Sativa.*)

This furnishes the bread for half the world. The Chinese tell us they used it two thousand eight hundred years before the birth of Christ. The modes of planting are various, though it flourishes best on land that can be flooded. The beautiful saying of our Saviour, "Cast thy bread upon the waters, and thou shalt find it after many days," had reference to the sowing of the rice upon the river Nile, when it had overflowed its banks. There are many kinds of rice, one hundred and sixty-one varieties being found in the Island of Ceylon alone. The favorite variety, called "long grain," is said to have been obtained by a man who noticed some very large grains in his harvest, and planted them. Another illustration of the doctrine of selection. A New York man, by the name of Calvin Emmons, invented the machine for cleaning rice, now used in the Southern States. Is it not curious that the value of the two great products of the South has been so much enhanced through the inventions of two men from the North, Emmons, and Eli Whitney, who invented the cotton gin? Our census reveals a curious fact in reference to the rice culture, showing that there is now raised in this country but about one-third as much as was produced twenty years ago.

CORN.

(*Zea Mays.*)

This is eaten by more persons than any other grain, except rice. Its chemical composition is found to be admirably adapted to the wants of the human family. The varieties are exceedingly numerous, there probably being a hundred in this country alone. They range from the little Brazilian variety, the grain of which is not larger than a mustard seed, and the ear the size of your little finger, to the stately southern corn, from twelve to twenty feet in height. We can see, by observing the corn, how the seeds of plants are produced. When it is in blossom, if we shake the stem fine dust from the stamens on top will fill the air, and if this falls upon the little pistils, commonly called the silk of the ear, it will fertilize, at the inner end, the ovule, and form the grain of corn. This is essentially the process of fertilization in all flowering plants. It explains what we wondered at when we were boys: why the pop-corn, which we planted with such bright anticipations, proved, in the autumn, to be something else, that "wouldn't pop worth a cent;" the pollen of other varieties had fallen

on the silk. Prescott says that the discovery of Columbus, viewed in its results, was the greatest achievement ever wrought by a human being. The introduction of corn into the old world was not the least of these benefits. In 1872, there was raised in this country, seven hundred and sixty million nine hundred and forty-four thousand five hundred and forty-nine bushels of corn. We shipped abroad, in 1873, twenty-five million bushels. The largest yield of corn recorded for a single acre, is two hundred bushels. It was raised by Dr. Parker, of South Carolina. A smaller area has yielded at the rate of two hundred and sixty-three bushels.

The practice of sowing corn for fodder is of recent origin, and the man who will invent a process for curing it rapidly and thoroughly, will take rank as a public benefactor.

The Arabs have long been in the habit of selling to unsuspecting travelers: "Mummy corn, from the tombs of Egypt." It is a pity to explode so fine a fancy, but as our maize (corn) was unknown to the Egyptians, of course there could have been none in their tombs. The term corn, in the early times, embraced a number of grains, hence Mrs. Whitman, in a fine description of Ceres, the goddess of the harvest, does not violate any of the dramatic unities when she says:

"All the wealth
Of wreathed poppies and of sheathed corn
By Ceres, on her stately temples borne."

WHEAT.

(*Triticum Vulgare.*)

It ranks third in quantity of the grains raised for food, and first in civilized lands. It is raised most extensively in the United States, Russia, Turkey, Denmark, Hungary and Chili. Two of the great wheat countries are now in mortal conflict. The loss to their productive industry must be immense, and its effects upon the price of bread-stuffs will tell more plainly next year than at the present time.

In 1874, our country raised three hundred and nine million one hundred and two thousand seven hundred bushels of wheat. The average yield per acre was twelve and three-tenths bushels. An astonishing illustration of western progress is shown in a report from California. In 1850 that State raised seventeen thousand two hundred bushels. In 1874, twenty-one million five hundred and four thousand bushels. A competent authority, in speaking of that region, says, that "from two thousand to four thousand acres is a moderate size for a wheat farm, and there are not a few ten times as large." The excellent variety, known as Tea Wheat, is said to have been first grown from seed found in a chest of tea.

There is perhaps no better example of wasteful farming, than that given by New York in the abuse of her wheat fields, where the average yield has declined from thirty to six bushels per acre, while that of England, after hundreds of years of cultivation, has risen from six to thirty.

RYE.

(*Secale Cereale.*)

Its origin is not known. It varies less under cultivation than any other grain, only two varieties, the winter and spring rye being sown. The firm and glossy straw is very useful for many purposes. Flourishing on new and poor soil, it seems to furnish the appropriate complement to the wheat crop, and yields, in many lands, the wholesome bread of the poor. In Sweden they make thin cakes of it and string them; they will keep thus for half a year. Our yield, in 1870, was twenty million bushels.

BARLEY.

(*Hordeum Vulgare.*)

This is more widely diffused, and more generally, though not largely used, than any other grain. In early times it formed one of the principal articles of food throughout the world. Now a great part of the crop, in many countries, is used, or rather misused, for the production of malt liquors; one of the most monstrous perversions of the bounties of Providence which can be found in the history of human sin and weakness. Our yield, in 1870, was fifteen million eight hundred and twenty-five thousand eight hundred and ninety-eight bushels.

OATS.

(*Avena Sativa.*)

This is one of our most beautiful as well as productive cereals. Its grains contain a very large amount of the phosphates, consequently it is an exhausting crop, and for the same reason is a stimulating and nourishing food. The old saying that a horse "feels his oats," is one of those attestations to truth which we sometimes find in popular language. The Irish use it extensively as an article of diet, and in the form of oat-meal it often finds a place upon our breakfast tables. No doubt it could be used more generally than it is, with decided advantage. Dr. Johnson, it seems, did not have a very high opinion of it, as he certainly did not of Scotchmen, for he sneeringly remarked: "In England, oats are food for horses, in Scotland they are food for men." Two or three varieties are particularly common. Probably the best, the potato-oat, was accidentally found in a potato field. This, again, shows us the value of farmers keeping their eyes wide open.

In 1870, there were raised in the United States, two hundred and eighty-two million one hundred and seven thousand one hundred and fifty-seven bushels. Fifty bushels on a single acre is a good crop, though a greater number is not uncommon. There were produced, on the farm of the Institute, this summer, on five-sixteenths of an acre, (the piece selected for measurement), twenty-eight bushels and one

peck; which would make a fraction over ninety bushels to the acre; these were the horse-mane oats, so called because the grains incline to one side of the stalk.

MILLET.

(*Panicum Miliaceum.*)

The branch of the grass family to which this belongs, is not remarkable for useful members. There are eight hundred and fifty species of this genus, and millet is the only one that is of much value. Millet is sometimes ground for meal, and is said to contain more nutritious matter than any other grain.

The name was given to this grain from the latin, *mille*, thousand, on account of the vast number of its seeds. Speaking of the number of seeds, I am reminded of the interesting table furnished by Mr. Flint:

June Grass, about	3,888,000	seeds to the pound.			
Orchard “	“	640,000	“	“	“
Timothy “	“	1,100,000	“	“	“
Sweet Vernal “	“	923,200	“	“	“

INDIAN RICE, WATER OATS.

(*Zizania Aquatica.*)

Most persons must have observed this beautiful plant growing in the marshes and on the banks of our rivers. The Indians, in their savage state, have always used it extensively for food. Pushing their canoes through the graceful branches, as they grow up out of the water, they bend them, and beat off the seeds into their boats. The stalk itself, when tender, is said to be the sweetest of grasses. The rail bird and the Baltimore oriole are exceedingly fond of its seeds, and seek it on the shores of the Delaware and Chesapeake, to the great delight of the watching sportsman. More than one author has recommended that civilized man should adopt and domesticate this wild, but promising denizen of the forest, one remarking: “This plant seems to be designed by nature to become the bread-corn of the North.” Nature sometimes seems to pour her richest gifts into the laps of her idlest children. The amount of ground, which, in wheat, would support one man, in bananas would sustain twenty-five. No “sower goes forth to sow” the wild rice of the cold northwest, but a little observation will reveal the truth, that she brings her choicest treasures to the noble toilers in her fields.

SUGAR CANE.

(*Saccharum Officinarum.*)

The sources of sugar are numerous. In early times it was produced from dates, bananas, and other fruits. The maple, in our own section, yields a large quantity. Beets, sorghum, corn and sugar cane have it in considerable amount, but our greatest source of sup-

ply is the last mentioned. The West Indies and Gulf States yield immense quantities, which are shipped to all quarters of the globe. The mode of planting is quite similar to that practiced in the raising of corn, though cuttings are planted instead of seeds.

A very interesting member of the genera sorghum, to which the sugar cane belongs, is broom-corn. We owe this valuable grain to the investigating habits of Dr. Franklin. Being shown a curious brush which had been brought from eastern Asia, he examined it carefully, and found a single seed; he planted it, and this was the beginning of the great industries which are now connected with the cultivation of this plant and the production of brooms. This is not the only blessing which farmers have derived from that wonderful embodiment of common and uncommon sense. The precepts of "Poor Richard" still pass as current coin among them. To him we owe the introduction of plaster as a fertilizer. It is said that he brought it into use by sowing it over a field of grain on a hill-side, so as to form, in immense letters, the sentence, "Effects of Gypsum." The rapid growth which followed, soon made the plaster speak for itself.

BAMBOO.

(*Bambusa Arundinacea.*)

This is the king of the grasses, and stands head and shoulders above all the other members of his excellent family, for he sometimes rises to the height of one hundred feet. It is not his stature alone that makes him great, but the varied and useful qualities which he possesses. We cannot do better than quote a description of the wonderful and almost innumerable uses served by this member of the grass family.

"The young and tender shoots are boiled and eaten, or preserved by the confectioners, and, as sweetmeats, are delicious. The roots serve many curious purposes. The tubes are in constant use in many departments of human industry; not only are entire houses and boats made of them, in some cases, but various kinds of ornamental screen work, for interior decoration; also the yards of vessels, and the tacking poles by which boats are propelled in calm and shallow waters. The straightest of the tubes have been used for astronomical purposes, and cheap aqueducts are in common use, formed by fitting the ends together. Shreds are made from the bamboo by softening it in water and flattening the section, and these when split fine are made into rain cloaks. Floats to tie on the backs of little children who live in boats on rivers, as well as the poles by which strong coolies carry burdens, come alike from this tree. Water-wheels, ropes, chairs, tables, bookcases, boxes, hats, umbrellas, pipe-sticks, fancy fan-cases, cups, measures for grain, shields, pike and spear handles, and paper, all are formed from the bamboo. The pith is used for lamp-wicks, and exquisite carvings, inlaid with silver and gold, and far more el-

egant than ivory work, are produced from the hard stem. From the large quantity of silex in the wood, thin slices make good knives."

After this description, none will be disposed to dispute the title of the bamboo as "king of the grasses."

Such are a few of the most important members of this interesting family. Let us now briefly consider their homes.

MEADOWS.

The plowing of land for the sowing of grass is of comparatively recent origin, but the nurturing of meadows for the production of hay is of early date. This was very largely accomplished in the east by means of irrigation. A remarkable illustration of the effects of improved culture can be found in the history of the Moors in Grenada. Having conquered this portion of Spain, which is not remarkable for its agricultural excellence, they introduced the improvements of their own country, building aqueducts and canals for flooding, and raised the products of her soil to an annual sum of thirty millions of dollars,—more money then than the yearly revenue of all the Christian sovereigns of the world. Irrigation is the source of the fertility along the Po, on the plains of Lombardy, and the meadows around Edinboro, over the latter of which they pour their liquid manures, and thus secure the astonishing yield which has been already mentioned. Our meadows are abused and not farmed. We stint them of seeds and rob them of fertilizers. If this continues it is not difficult to foresee the result. The practice of selling our hay if not carefully watched, will surely impoverish these fertile valleys. We have already learned from the census maps where our strength lies. If we continue to shear our fields and deprive them of their strength, they will become like Samson shorn of his hair. Rather double the seed, use every pound of fertilizer you can get, plow under the rich growth of grass and weeds, and with the nicest care guard one of the richest treasures ever vouchsafed to a prosperous people.

PASTURES.

The earliest traditions of the world are connected with a pastoral life. The wealth of the early generations consisted chiefly in flocks. The future King of Israel tended the cattle, and from the beautiful scenes around him received those poetic impressions which are often breathed forth from his inspired lyre, now rising to sublime strains, now sinking to pensive and restful sweetness as he sings: "He maketh me to lie down in green pastures; He leadeth me beside the still water."

Our own pastures yield the largest amount of our money, but their beauty is sometimes hard to see. When do the cattle bring the farmer his gains? In the summer. When, then, should they be best fed? We answer, in the summer. Let them go in clover and timothy up to their eyes, not in the marshes, where there is nothing to

eat but brambles and blackberry vines. I am satisfied we have too much land in our pastures; half as much, brushed, seeded, harrowed or plowed, and sowed, would give a far richer return.

A better opportunity for a display of judgment, skill and good economy, was never offered than that presented in the problem, How shall we improve and bring to the highest productiveness, our pasture lands?

PAMPAS.

Stretching away from the base of the Cordilleras, and elsewhere in South America, these great plains extend over an area of a million and a half square miles, equal to half the surface of the United States. Here countless herds find abundant pasture. Though there were no cattle in South America at the time it was discovered, it is estimated that there are now more feeding wild on the pampas, than there are of domesticated cattle in all Europe. They live chiefly upon a luxuriant growth of clover and thistles, greatly preferring them to the pampa grass. If the bamboo, by reason of strength should be crowned king, the pampa grass, by reason of beauty, should be named "queen." Rising to the height of six feet, with a breadth as great, it throws up lofty panicles, ten or fifteen feet from the ground, waving with a silky and silvery lustre; its splendid flowers, sometimes tinted with yellow and purple, and the great leaves, occasionally varied with white. Imagine a horseman, with lasso in hand, riding at full speed under their nodding plumes, after the fleeing herd, and you have one of the most picturesque scenes of that southern land.

PRAIRIES.

Buffalo paths and Indian trails are rapidly giving place to public highways and railroads. Yet there will long linger in the traditions of men, stories of the earlier times, when the wild beast fed upon the rich prairies of the west.

The Buffalo Grass, like its associate in name, is the hardy native of our soil. It seems fitted to resist alike the heat of summer and the frosts of winter. The pioneer often finds it to be his best friend, though old men tell of fearful scenes, when, wrapped in flames and smoke, it threatened to become to them a billowy sea of death.

LAWNS.

The wavy outline of these blue hills and sky is beautiful. These magnificent forests are grand, but there is one element of loveliness which our section possesses that surpasses all others,—it is the richness, greenness and abundance of our grass. Shall we not make the most of it? Let us spread it out smooth, like a carpet, even and velvety, before our homes. Displace the pig-pen and the wood-pile from the front yard, straighten the fence, curve the paths, cut down the weeds, and let the grace and beauty that surround the English

cottage, adorn the places where we live. I plead for the wife and children, that they may have a spot for flowers and fragrance, the green turf, soft to the weary feet, for romping and croquet in the evening twilight: tall trees to spread their ample shade along the road, not less than blossoming orchards in your fields. A little taste would transform scores of places that we see, now harsh and repulsive, into pleasant and attractive homes. There may be no carpet on the floor, but there can be one spread upon the yard, fairer than Tyrian purple and more enduring than the costly fabrics of Brussels. Oh! when shall we learn that "the life is more than meat," that it is wise to gladden the hearts of wives and children, and the aged, by surrounding our homes with the atmosphere of beauty?

LANDSCAPES.

There is one who has striven all his life long to awaken in the hearts of English-speaking people, the sentiment of love for the beautiful. A poet who writes in prose, a painter who never touches brush to canvas,—Ruskin, the art critic of old England. Listen to his matchless words as he points out to us such loveliness as we never saw in grass before:

"The Greeks, we have seen, delighted in the grass for its usefulness; the mediæval, as also we moderns, for its color and beauty. But both dwell on it as the *first* element of the lovely landscape. Gather a single blade of grass and examine for a minute, quietly, its narrow, sword shaped strip of fluted green. Nothing, as it seems there, of notable goodness or beauty. And yet, think of it well, and judge whether of all the gorgeous flowers that bloom in the summer air, and of all strong and goodly trees, pleasant to the eye and good for food, stately palm and pine, strong ash and oak, scented citron, burdened vine,—there be any by man so deeply loved, by God so highly graced, as that narrow point of tender green. And well does it fulfill its mission. Consider what we owe merely to the meadow grass—to the covering of the dark ground by that glorious enamel, by the companies of those soft and countless and peaceful spears. The fields! Follow forth but for a little while the thoughts of all that we ought to recognize in those words. All spring and summer is in them—the walks by silent, scented paths—the rests in noonday heat—the joy of herds and flocks—the power of all shepherd life and meditation,—the life of sunlight upon the world, falling in emerald streaks, and failing in soft, blue shadows, where else it would have struck upon the dark mould or scorching dust,—pastures beside the pacing brooks,—soft banks and knolls of lovely hills,—young slopes of down, overlooked by the blue line of lifted sea,—crisp lawn, all dim with early dew, or smooth in evening's warmth of barred sunshine, dinted with happy feet, and softening in their fall the sound of loving voices. All these are summed up in those simple words;

and these are not all. As you follow the winding mountain path, beneath arching boughs all veiled and dim with blossoms,—paths that forever droop and rise over the green banks and mounds sweeping down in scented undulations steep to the blue water, studded here and there with new-mown heaps, filling all the air with fainter sweetness, look up toward the higher hills, where the waves of everlasting green roll silently into their long inlets among the shadows of the pines; and we may, perhaps, at last know the meaning of those quiet words: ‘He maketh grass to grow upon the mountains.’”

CONCLUSION.

In conclusion:—Be proud of your farms, whether large or small. Know that the landholder is the true lord. It has ever been so. That is a fine old picture given us of Cincinnatus at the plow, going from it as dictator to save his country, and quickly returning to it when his task was done. The world looked on in wonder to see that act repeated on a large scale in our own day, when our farmers and their sons left their plows to save their country, and when their work was accomplished, contrary to the sneering prophesy of tyrants, hastened back to resume their labors.

Horace Greely thus closes his history of the American Conflict; “Thus rapidly, as well as peacefully and joyously, were the mightiest hosts ever called into the field by a republic, restored to the tranquil paths of industry and thrift, melting back by regiments into quiet citizenship, with nothing to distinguish them from others but the proud consciousness of having served and saved their country.”

A distinguished officer in our regular army, owns a poor little farm on the coast of Rhode Island. He never lives on it, but cherishes it with the fondest care; for, said he to me, “It has been in our family two hundred years, descending from father to son, to my boy next, and so on I hope till the crack of doom.” Young men, are you eager to leave the farm-house and the farm? You make a great mistake. Mercantile life in the city has nothing to offer you as an equivalent for what you lose. Careful statistics show that 95 per cent. of the young men who go from the country to seek their fortunes in the city, make a failure. Tilling the soil is better work than measuring tape. It will be a happy day for our country when this wretched disposition among our young people, to leave the fields and manual labor for the hazards of business, shall be radically changed. The professions are over-stocked. The banks and stores have more clerks than they want; but the blessed acres of God are still plentiful, and invite all willing hands to seize their riches. Let the young farmer become intelligent and observing. Let him secure the best education the country affords, and it is in his power; remembering that it is mind that conquers matter, that thought alone creates invention, overcomes the barrenness of soils, supplies fertilizers, crowns the earth with fertility, and blesses man with wealth and a higher civilization.

Be proud of your heritage and happy in your work. When Croesus, the wealthiest man of antiquity, asked Solon, the wise man of Greece, who he thought was the happiest man in the world, Solon answered: "Tulus, an Athenian, for he owns twelve acres of land which he tills with his own hands, and possesses a lovely wife and ten contented children."

Yours is a life of toil, of hard hands and sweaty brows, but it may be blessed with virtue, health, plenty, and more than kingly independence, for

"Honor waits o'er all the earth,
Through endless generations;
The art that calls her harvests forth,
And feeds the expectant nations."



APPENDIX.



Through the courtesy of Ivison, Blakeman, Taylor & Co., of New York, I am permitted to use the beautiful lithographic engravings of the grasses published by them in their admirable work, "The Lessons and Manual of Botany," by Prof. Asa Gray. The illustrations cover the whole sixty-six genera mentioned and described by him. I have also used his explanations of the plates, simply adding such remarks as will make them intelligible to any who may not have a critical knowledge of the subject.

The parts inclosed in each parenthesis are explanatory of what immediately precedes them, thus:—*Leersia oryzoides*, (Rice Cut-grass.)

The first name, printed in larger type, is the name of a genus; the second word, which is afterwards joined to it, is the name of a species of that genus; for example, *LEERSIA*, (genus), *Leersia oryzoides* (the name of a species), and so on through all the explanations.

LEERSIA (White Grass).—Panicle of *Leersia oryzoides* (Rice Cut-grass) reduced in size (1); a branchlet of the same, with its spikelets (little flowers of the grasses), of the natural size (2); and an open spikelet in flower, enlarged (3).

ZIZANIA, (Water or Indian Rice).—A staminate (flowers having stamens but not pistils), (1), and a pistillate (flower having pistils but not stamens), (2), flower or spikelet of *Zizania Aquatica* (Indian Rice, Water Oats); a magnified pistil with a pair of scales (3); a grain (4); and a magnified longitudinal section of the lower part of the same, showing the embryo (the rudimentary, undeveloped plantlet in the seed) at the outside of the base of the albumen.

ALOPECURUS (Fox-tail Grass).—Part of a plant of *Alopecurus geniculatus* (Floating Fox-tail) in flower (1); a few spikelets from the spike-like inflorescence (mode of flowering), moderately magnified (2); an open spikelet in flower, more magnified (3), and the single lower palet (chaff) detached (4).

PHLEUM (Cat's-tail Grass).—A detached spikelet of *Phleum pratense* (Timothy Herd's Grass in New England and New York) having the flower with its palets (chaff or minor husks of grass) raised above the glumes (chaff or outer husks of each spikelet), magnified.

CRYPISIS (Crypsis).—Inflorescence (1) of *Crypsis scholnoides*; a separate enlarged spikelet (2); and the same open, in flower (3).

VILFA (Rush Grass).—An enlarged spikelet of *Vilfa vaginaeflora* (1) and the same displayed (2).

SPAROBIOLUS (Drop-seed Grass).—A spikelet of *Sparobolus cryptandrus*, magnified (1); the same with the flower open, the palets raised above the glumes (2); and the fruit (3), more magnified, showing the seed loose in the pericarp (the skin or covering of the seed).

AGROSTIS (Bent-grass).—Panicle of *Agrostis vulgaris* (Red-top, Herd's-grass in Pa.) (1); with an enlarged open spikelet of the same; also (3) the rough pedicel (the stalk of each particular flower of a cluster) and glumes or chaff of *Agrostis scabra* (Hair grass) with the flower separated, the latter having no upper palet or chaff.

Genera of Grasses.

PLATE VII



Phleum

POLYPOGON (Beard-grass).—Spike-like, contracted panicle of *Polygonum Monspelienis* (1); an enlarged, detached spikelet, showing the long awns (a bristle-like appendage to the flower of some grasses) to the glumes (2); the same open in flower (3); and a separate flower without the glumes (4).

CINNA (Wood Reed-grass).—A magnified spikelet of *Cinna arundinacea* (1); and the same open, displaying the palea, the single stamens and the pistil (2).

MUHLENDERGIA (Drop-seed).—A magnified closed spikelet of *Muhlenbergia sylvatica* (1); the same with the open flower raised out of the glumes (2); a magnified spikelet of *Muhlenbergia diffusa* (Nimble Will) (3); its minute and unequal glumes more magnified (4); and an open spikelet of the same (5).

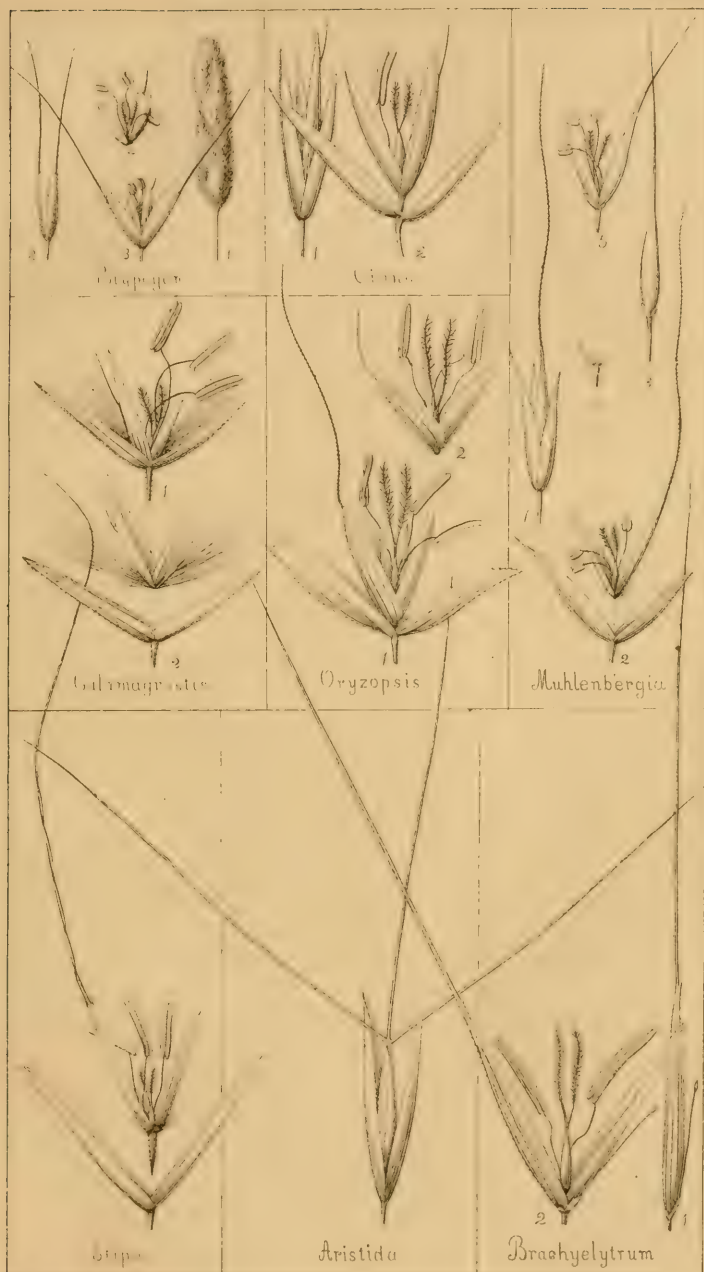
BRACHYELYTRUM.—A spikelet of *Brachyelytrum aristatum* enlarged (1); the same displayed (2);

CALAMAGROSTIS (Reed Bent-grass).—An open spikelet of *Calamagrostis Canadensis* (Blue Joint-grass) enlarged, displaying all the parts (1); the same with the flower raised out of the glumes, showing the hairy rudiment behind the upper palea (2).

ORYZOPSIS (Mountain Rice).—An open, magnified spikelet of *Oryzopsis asperifolia* (1); and the flower of the same removed from the glumes (2). Notice the remarkably long hypogynous (inserted under the pistil) scales, which here nearly equal the paleas in length.

STIPA (Feather-grass).—Glumes and flower (a little separated) of *Stipa avenacea* (Black Oat-grass) enlarged.

ARISTIDA (Tripple-awned Grass).—A spikelet of *Aristida purpurascens*, enlarged.





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SPARTINA (Cord or Marsh Grass).—Portion of the inflorescence of *Spartina stricta* (Salt Marsh Grass) of the natural size (1); a spikelet enlarged (2); and the same displayed, the flower raised above the glumes (3).

CTENIUM (Toothache Grass).—Spike of *Ctenium Americanum* (1); a single spikelet magnified (2); and the same displayed, the glumes separated (3).

BOUTELOUA (Muskat Grass).—A portion of the compound spike, of the natural size (1); and a spike displayed and magnified (2); the flower raised out of the glumes.

GYMNOPOGON (Naked-beard Grass).—Inflorescence of *gymnopogon racemosus*, reduced in size (1); and a magnified spikelet with the parts displayed (2).

CYNODON (Bermuda or Scotch Grass).—Inflorescence of digitate (spreading out like the fingers of the hand) spikes (1); a spikelet magnified and displayed, showing a perfect flower and a rudiment (2).

DACTYLOCTENIUM (Egyptian Grass).—Inflorescence of *Dactyloctenium Egyptiacum*, of digitate spikes (1); one of the spikelets magnified (2); the fruit magnified (3); showing the seed loose in the thin pericarp, and (4) the wrinkled seed more magnified.

ELEUSINE (Crab-Grass Yard-Grass).—One of the spikes from the digitate inflorescence of *Elusine Indica* (Dog's-tail or Wire Grass) (1); a magnified spikelet (2); the same with the flowers more displayed (3); a flower of the last, showing its parts (4); the fruit showing the seed loose in the pericarp (5); and the wrinkled seed detached (6).

SEPTOCHLOA.—Small portion of the inflorescence of *Septochloa fascicularis* (1); one of its spikelets displayed and magnified (2); an open flower of the same (3).



Spiraea

TRICUSPIS.—Magnified spikelet of *Tricuspis sulerioides* (Tall Red-top) (1); the same displayed and the lowest flower open (2); back view of the lower palets spread out (3).

GRAPHEPHORUM.—A magnified spikelet of *Graphephorum melicoides* displayed (1); a part of the hairy rhachis (the axis of the spike) and one flower of the same (3).

DIARRHENA.—A spikelet of *Diarrhena Americana* enlarged (1); the grain and palets (2).

DACTYLIS (Orchard Grass).—A spikelet of *Dactylis glomerata* magnified and displayed.

KOELERIA.—A magnified spikelet of *Koeleria cristata*, expanded, showing the glumes, the three flowers and a rudiment (1); lower part of a lower palet partly spread open (2); it is much more folded and keeled in its natural condition.

EATONIA.—A magnified spikelet of *Eatonia obturata*, expanded, showing the glumes, the two flowers and a rudiment.

MELICA (Melic Grass).—A magnified spikelet of *Melica nutica*, expanded, showing the glumes, two perfect (having stamens and pistils) flowers and an abortive one.

GLYCERIA (Manna Grass).—A magnified spikelet of *Glyceria nervaria* (Fowl-Meadow Grass) (1); a separate flower with one joint of the rachis (2); and (3) the lower half of a lower palet, showing its form (rounded on the back, not keeled).

BRIZOPYRUM (Spike Grass).—A pistillate spikelet of *Brizopyrum spicatum*, enlarged, (1); a flower from the same (2); and a flower from a staminate spikelet (3).

POA (Meadow Grass, Spear Grass).—Panicle of *Poa* compressed (Wire Grass) reduced in size (1); a magnified spikelet (2) a separate flower more magnified (3); a lower palet cut across and somewhat outspread (4).

ERAGROSTIS.—A spikelet of *Eragrostis pilosa* enlarged (1); the same from which the glumes and all of six lower flowers except the upper palet have fallen away (2); a magnified flower open (3); the lower palet of the same outspread (4).

BRIZA (Quaking Grass).—A spikelet of *Briza media* enlarged (1); a separate flower (2).

FESTUCA (Fescue Grass).—A spikelet of *Festuca elatior* (Taller or Meadow Fescue) enlarged (1); a separate flower (2); lower part of a lower palet outspread (3).

BROMUS (Broom Grass).—A spikelet of *Bromus secalinus* or chess (1); and a separate flower enlarged (2).



UNIOLA (Spike Grass).—A spikelet of *Uniola Latifolia* of about the natural size (1); a flower enlarged (2); empty lower palet of the lowest (sterile) flower (3).

PHRAGMITES.—A spikelet of *Phragmites communis* enlarged (1); one of the perfect (having both pistils and stamens) flowers, enlarged (2) and the lowest flower (3) which has stamens only.

ARUNDINARIA.—A spikelet of *Arundinaria macrosperma* (1); and a separate flower magnified (2).

LEPTURUS.—Portion of the spike of *Lepturus paniculatus* enlarged (1); and a flower magnified (2).

LOLIUM (Darnel).—Portion of the spike of *Lolium temulentum* (1) and a separate flower magnified (2). This is the only species of grass that is poisonous.

TRITICUM (Wheat).—Portion of the spike of *Triticum repens* (Couch Quitch or Quick Grass) of about the natural size (1); a flower magnified (2).

HORDEUM (Barley).—The three one-flowered spikelets from one joint of the spike of *Hordeum jublatum* (Squirrel-tail Grass) with their awn-like glumes, the lateral flowers abortive and neutral, the middle one alone perfect (1); this perfect flower (with an awn-like rudiment) open and enlarged (2).

ELYMUS (Lime Grass, Wild Rye).—The two spikelets of one joint of the spike of *Elymus Virginicus*, about the natural size (1); the glumes and the flowers of one spikelet enlarged and displayed (2); and an open flower more magnified (3).

GYMNOSTICHUM (Bottle-brush Grass).—A spikelet of *Gymnostichum Hystrix* (1); and an expanded flower magnified (2)

Genera of Grasses

Tab XI





AIRA (Hair-Grass).—Panicle of *Aira flexuosa* (Common Hair Grass) (1); a spikelet magnified, the parts displayed (2); and one of the flowers detached and open (3).

DANTHONIA (Wild Oat-grass).—Panicle of *Danthonia spicata* (1); a spikelet enlarged (2); and a separate flower of the same (3).

TRisetum.—A spikelet of *Trisetum subspicatum*, expanded and magnified (1); and a separate open flower (2).

AVENA (Oat).—A spikelet of *Avena stricta* displayed and magnified (1); and a separate flower (2).

ARRHENATHERUM (Oat-grass).—A spikelet of *Arrhenatherum averaceum* displayed and magnified (1); the glumes (2); the flowers, the lower one staminate only, the next one perfect, and the third a rudiment.

HOLCUS (Meadow Soft-grass).—A spikelet of *Holcus lavatus* (Velvet Grass) magnified (1); the same displayed to show the two flowers, the lower one perfect and awnless, the upper staminate and awned (2).



HIEROCHLOA (Holy Grass).—A spikelet of *Hierochloa borealis* (Vanilla or Seneca Grass) enlarged (1); the same displayed, the flowers separate from the glumes, the two lateral ones with their stamens and no pistil; the middle or terminal one with a pistil and only two stamens (2).

ANTHOXANTHUM (Sweet Vernal Grass).—The spikelet-like inflorescence of *Anthoxanthum odoratum* (1); a spikelet magnified (2); another with the parts displayed, the flowers raised from the glumes, the lateral ones neutral, each of a single and awned palet, the middle one perfect (3).

PHALARIS (Canary Grass).—A spikelet of *Phalaris a rundinacea* enlarged (1); the glumes and the perfect flower, with a hairy rudiment on each side of it (2).

MILIUM (Millet Grass).—Portion of the panicle of *Milium effusum* (1); a closed spikelet magnified (2), and the same displayed (2).

AMPHICARPUM.—A spikelet from the panicle of *amphicarpum Purshii* magnified (1); the same with the parts displayed (2); and a radicle (fertile) spikelet enlarged (3).

PASPALUM.—Inflorescence of *Paspalum laeve* (1); a closed spikelet enlarged (2); the same with the parts displayed (3).

PANICUM (Panic Grass).—Part of a spike of *Panicum (Digitaria) sanguinale* (Common Crab or Finger Grass) (1); one of its spikelets enlarged (2); the same with the parts displayed (3); in this the lower flower is neutral and of a single palet. A spikelet of *Panicum Capillare* (Old-witch Grass) magnified (4); and the same displayed (5); the lower flower a single palet. A spikelet of *Panicum clandestinum* magnified (6); and the same displayed (7) the lower neutral of two palets. A spikelet of *Panicum virgatum* magnified (8); the same displayed (9); the lower palets of two flowers and staminate.

SETARIA (Bristly Fox-tail Grass).—A magnified spikelet of *Setaria glauca* (Foxtail) with the accompanying cluster of bristles (1); the spikelet displayed, showing the neutral lower flower of two palets and the perfect flower (2).



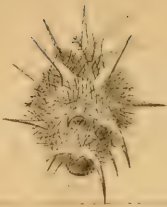
CENCHRUS (Hedgehog or Bur Grass).—Involucre (a whorl or set of little leaves called bracts under and around certain flowers) of *Cenchrus tribuloides* in flower enlarged (1); longitudinal section of the same (2); a spikelet displayed (3); the stigmas should belong to the right-hand flower; the left-hand or lower flower is only staminate.

TRIPSACUM (Gama Grass, Sesame Grass).—Piece of the spike of the natural size, pistillate below, staminate above (1); a longitudinal section of one of the pistillate spikelets (2); a pistillate spikelet with its parts displayed (3); a staminate (two-flowered) spikelet with its parts displayed (4).

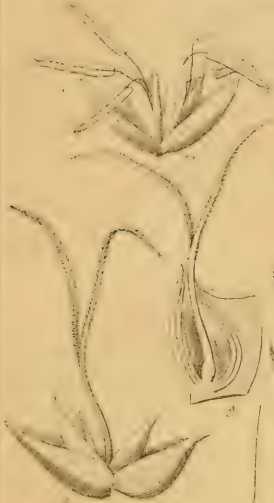
ERIANTHUS (Woolly Beard-grass).—Part of the hairy inflorescence with two spikelets of *Erianthus alopecuroides* enlarged (1); one of the spikelets displayed (2).

ANDROPOGON (Beard Grass).—Small portion of the spike of *Andropogon furcatus* enlarged, with one fertile and awned spikelet, and one staminate and awnless spikelet (1); the fertile spikelet (2); and the staminate (3) displayed.

SORGHUM (Broom Corn).—A fertile spikelet of *Sorghum nutans* (Indian Grass Wood Grass) enlarged, with a sterile pedicel (having no flowers on the flower stem) on each side (1); the spikelet displayed (2).



Cenchrus

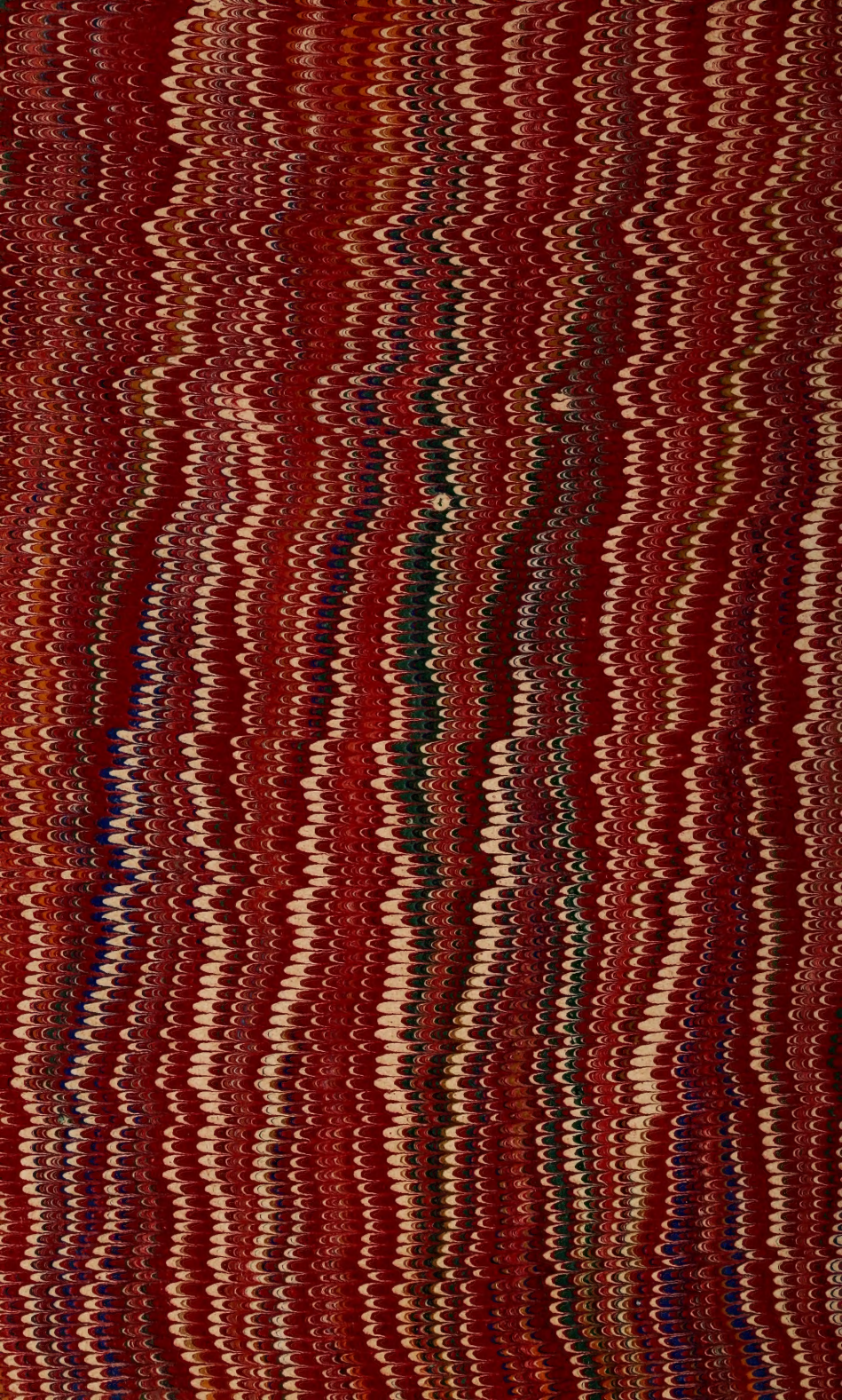


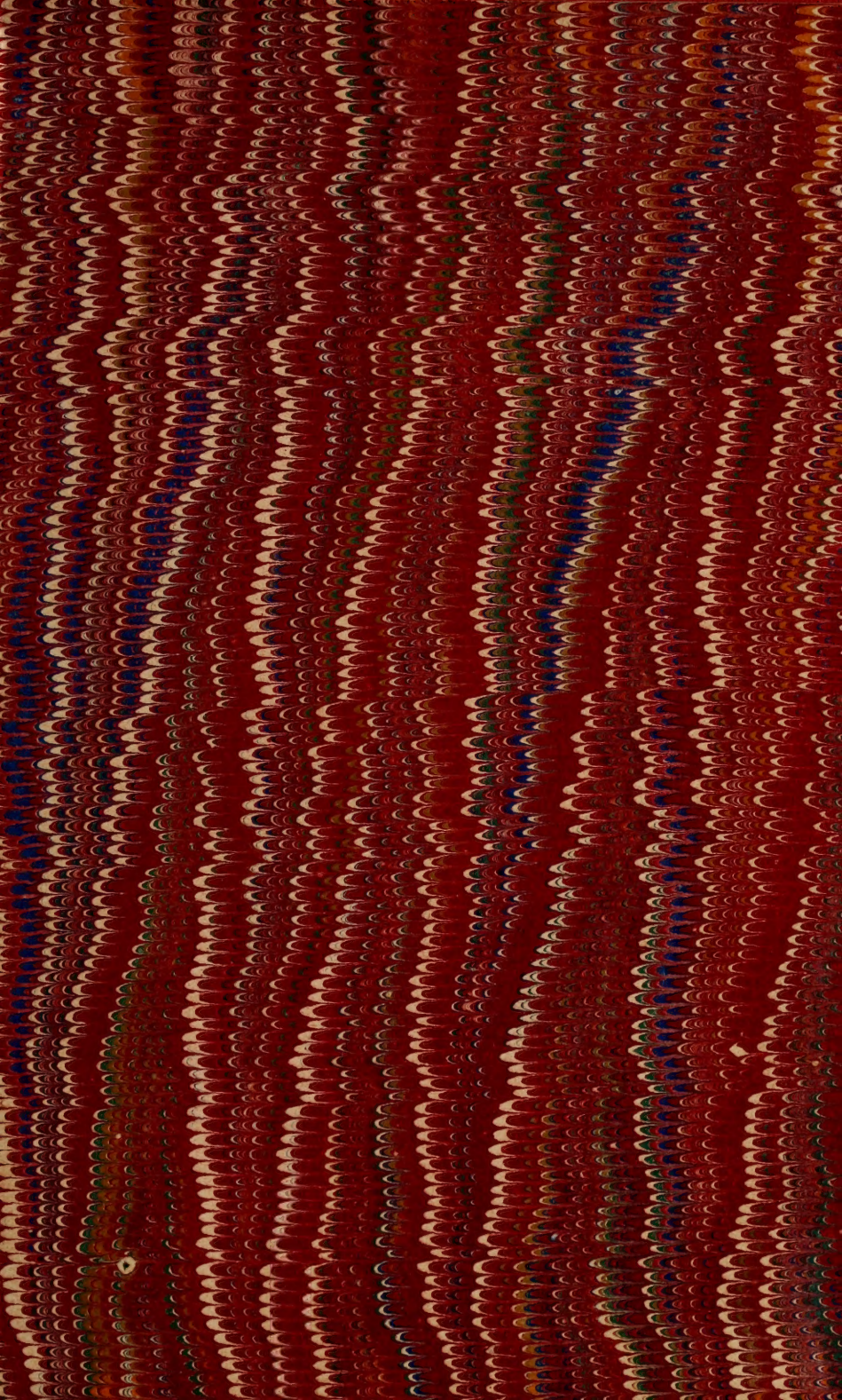
Erianthus



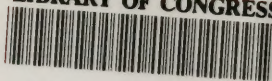
Sorghum







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